

5

AN
Inaugural Dissertation
ON
FRACTURES.

Submitted to the Examination of
THE REV. JOHN EWING, S.S.T.P. *PROFESSOR*,

THE
TRUSTEES AND MEDICAL FACULTY
OF THE
UNIVERSITY OF PENNSYLVANIA.

On the 12th Day of May, 1797.

For the DEGREE of DOCTOR of MEDICINE.

By ROBERT BLACK, OF PENNSYLVANIA,
Member of the Philadelphia Medical and Chemical Societies.

PUTA, LEGE, ET OBSERVA STUDIOSE.

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ORIGINAL DISSERTATION
ON THE
FRACTURES.

By JOHN LIVING, M.D., F.R.S.
FELLOW OF THE ROYAL SOCIETY.

1742

TRUSTEES AND MEDICAL FACULTY



UNIVERSITY OF PENNSYLVANIA

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In the DEGREE OF DOCTOR OF MEDICINE.

By ROBERT HARRIS, of PENNSYLVANIA,
Member of the Philadelphia Academy and Chemical Society.
AND
JAMES ET OBSERVAT. STUDIOS.

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P R E F A C E

TO

PHILIP S. PHYSICK, M.D.

SURGEON AND PHYSICIAN

TO THE

PENNSYLVANIA HOSPITAL, &c.

TO whom shall I, with so much propriety, dedicate the following dissertation, as to the man under whose direction my medical studies have commenced, and been continued with pleasure and satisfaction; accompanied with numberless opportunities for improvement. Permit me, when departing from you to take my station on the busy theatre of life, to intreat a continuance of those salutary councils, which I have found so useful during the course of my studies. That your career through life may be as lasting and happy as it has hitherto been brilliant and useful, is the most ardent wish of your sincere friend and affectionate pupil.

ROBERT BLACK.

P R E F A C E.

IT is a common observation, and not unfrequently a true one, that every institution which exacts from a young man some public test of his acquirements in the science which it embraces, previous to his receiving any of its honours; imposes on him the disagreeable task of publishing his ignorance and blunders to the world. Many reasons offer why this should be the case in medicine. The science embraces such a variety of subjects, as ANATOMY, CHEMISTRY, MATERIA MEDICA, the INSTITUTES and PRACTICE, that a man, who in the usual time allotted to the study, acquires a general knowledge of each, may be said to have spent his time well, without having strictly attended to any particular subject as destined for a future dissertation. Add to this, that many men, whose knowledge is accurate and extensive, are by no means calculated for authors.

WHEN science and government are stripped of their useless garbs, and men return to the simplicity for which they were originally designed, and in which they were created, those hideous monsters, which now oppose improvement and perfection, will cease to exist. Should our sleeping dust resume its native form in this happy æra,

we would find medicine holding the foremost rank among the sciences; that its promotion, like liberty and equal rights, had become a common cause; and that its empire over disease was universal.

It is both unnecessary and useless to go into the merits of theses in general. They principally consist of extracts from the various writers who have treated of the subject which the author has chosen; and perhaps their greatest advantages are to let the world know how many volumes he has perused; and to fix his attention upon a particular subject while a thousand others, equally demanding it, are neglected.

NECESSITY is a hard task-master. A man, whose business obliges him to have frequent connection with the world, must, in some degree at least, conform to its customs and manners.

COMING forward into the literary world under equal disadvantages with students in general, with them I claim equal indulgence.

FROM the earliest period of my studies, a predilection for surgery was instilled into my mind; and it has increased through their whole course. Perhaps a better reason cannot be given, why I have chosen fractures for the subject of the following dissertation.

A N

Inaugural Dissertation.

ON FRACTURES.

FRACTURES will constitute the subject of the following dissertation.

To treat expressly of every possible variety of form, in which these accidents may appear, and of all the symptoms attendant upon or consequent to them, would afford ample matter for volumes; and therefore would be altogether foreign to the present purpose. I propose to confine myself to some general observations on the mode of reduction,—position of the limb, in fractures of the lower extremities,—method of obviating the most common symptoms, and of relieving them, when, from neglect or other causes, they do occur.

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WHEN we consider how large a portion of human misery these accidents constitute ; how permanent they are in their effects ; and how frequently alarming in their termination ; sometimes even proving fatal ; we will not be surprized to find, that since the days of HYPOCRATES to the present age, they have at all times occupied the attention of practitioners of the healing art.

THE present appears to be an age of investigation. Mankind are eager to attain even to absolute perfection ; and medicine has not been deficient in producing its full proportion of characters, whose enthusiasm has been such as to surmount the most formidable obstacles. Although the science of surgery has arrived at a very high degree of perfection, yet still there exists considerable difference of sentiment on many points ; and perhaps on none more than on which is the best mode of treating fractures.

THE subject is important ; and it is a matter of consequence to examine the different modes of practice, and investigate the arguments adduced in support of them. By these means, perhaps some further light may be thrown on the matter ; and any thing, which will tend to elucidate a subject of so much importance, cannot be considered as unworthy the attention of men, who

wish to make an accurate knowledge of the healing art their pursuit.

A COMPLETE solution of continuity in a bone, produced either by muscular action or external violence of any kind, may be termed a fracture. This definition appears to be unexceptionable ; as by it we exclude solution produced either by disease in the bone or some adjoining part.

LUES VENEREA of long continuance is said by authors sometimes to affect the bones so much, that ordinary muscular action is sufficient to break them.

THE venereal disease, as Mr. HUNTER has ingeniously proved, is capable of producing its action only in a local form ; and there is a gradual progression from the parts first in order of susceptibility, to the second. When it attacks the bones, the immediate effects of its action are pains, inflammation, and thickening of the periosteum ; but it sometimes goes further, and kills parts of the bones ; and exfoliations of greater or less extent are the consequences. All this is nothing more than is produced by loss of life in a bone from any other cause, and cannot be supposed to create diseases so much more alarming.

But when a physician, who is too lazy or too stupid to think, meets with a puzzling case; and can only find out that his patient has been so unfortunate as to have had the venereal disease ten or fifteen years before, he immediately flies to it as a city of refuge, and congratulates himself with having found LATENT VIRUS.

THAT the venereal disease is capable of exciting previously existing dispositions into action, and also of producing new states of the system which in their turn shall produce new diseases, is true; but it is equally true with respect to many other diseases, and that in as eminent a degree.

THERE is a disease called MOLLITIES OSSIUM, which renders the bones so soft and flexible, that they are incapable of sustaining the weight of the body. In the first stage of this disease the bones are brittle, but it sometimes arrives at such a height, that they become crooked and distorted in the most unseemly manner*.

FALLS, blows, and bruises, are said by writers, to be the common causes of fractures: but

* Mr. Bell, in the sixth volume of his surgery, page 13th, observes, that he had seen a skeleton in which the condyles of the knee joints were turned up to the pubes, and in which every other bone was crooked in nearly a similar degree.

these, abstractedly considered, will not account for all, perhaps not even a majority of them. A little examination and reflection will be sufficient to prove, that the muscular system is a very principal agent in the production of fractures; at least in most, if not all those that occur from falls, leaping, &c. In proportion as muscular action is vigorous, such accidents are apt to produce fractures, and vice versa. Of this truth there are many proofs.

A GREAT number of those persons who receive broken bones from leaping or falls, are perfectly sober and in full vigour at the time. The exclusive action of muscles not unfrequently produces both fractures and luxations. I have heard of a man, who, by the simple agency of his muscles, could dislocate his os femoris when he chose. A gentleman in this city broke his arm by the exertion of striking his servant. And there can be no reason why, when acting in conjunction with an external cause, they should not produce similar effects, even in a greater degree: for we know that such causes produce violent and convulsive action of the muscular system. And in order to induce a fracture, a bone need be thrown but very little off its center of gravity. The impression made on the muscles will be unnatural, their action will be unnatural, and

an injury to the part, most easily affected will be the consequence. In addition to all this we may observe, that persons who are drunk, or under the operation of any cause that produces relaxation of the muscular system, although they fall from a considerable height, seldom receive a broken bone.

THE practitioners of surgery of the present day are much divided with respect to the best mode of reducing and placing the fractured limb. Mr. POTT was the first man who warmly recommended the bent position. It is the child of his own production, and he has magnified it into an improvement of more general utility than experience would seem to warrant. Mr. BELL has implicitly followed him; and at the same time that he recommends the bent position, not only while reducing, but during the whole of the cure, advises the corresponding limb to be used as a criterion to determine whether the parts are completely replaced. As this is impracticable, we conclude Mr. BELL means that the limb be first flexed and reduced as near the natural state as possible, then straightened and compared with the corresponding sound limb, any existing imperfection remedied, placed again and retained in the bent position: and undoubtedly the surgeon should have some re-

ward for all this trouble ; we will therefore examine the comparative advantages and disadvantages of the *bent* and *straight* positions.

THE muscles are arranged under three classes, viz. Voluntary, Involuntary and Mixed.

THIS classification must have been induced, not in consequence of any difference in the mechanism, or particular quality of the matter forming the muscle, but because certain muscles were found to act independent of, and even in opposition to any influence of the will. Altho' the action of others can go on without any influence of the will, yet it may be accelerated, impeded, or even stopped at pleasure. The voluntary muscles are completely under the government of the will, and may be considered as the slaves of a monarch : when it gives the stimulus to action they obey ; and at its pleasure are quiescent. A muscle is incapable of receiving or obeying two impressions at the same time, therefore it cannot contract and relax at one and the same time. This is equally true with respect to two antagonizing muscles. When a man is bending his leg, the extensor muscles as certainly receive the stimulus to relaxation, as the flexors do to contraction : their stimuli are also in ratio to each other. To admit the idea of a muscle perform-

ing two actions at once, would be as absurd as to suppose two fevers can exist together.

In consequence of this sovereign controul of the will over the muscles, any, and every part of the body remains in whatever position we place it, until our will or fatigue gives the stimulus to change of posture, which would not be the case if the muscles were disobedient. They will also in a short time adapt themselves to an unnatural position. I will even carry the matter further, and assert, that when a man is laid on his back in a horizontal posture, which appears to be the most natural and easy, his voluntary muscles will become as completely quiescent and inactive as his bones,

It must be observed that I have been considering the body as in a healthy state, and capable of performing natural action. In disease the case is much reversed. When a disease makes a part or the whole of the muscular system its seat, actions peculiar to itself are the consequences: these are totally independent of the will, and over them it has no controul. I have known a gentleman receive a prick at the thumb joint from a spicula of bone; a slight inflammation took place; the consequence of which was a total incapacity to perform any motion of the

13
thumb by mental influence, although several of its muscles are seated upon the arm considerably distant from the diseased part. The same thing takes place in cases of fracture: any and every muscle connected with the injured part, and stimulated into action by disease in that part, performs convulsive or wrong action, which will continue as long as the cause producing it continues to give the stimulus, and the parts are susceptible of it; and every effort of the will to check it must be ineffectual. These arguments, it is presumed, are sufficient to prove satisfactorily, that it is not the *mere* position of the limb, but wrong action in the muscles connected with it, that produces so many crooked limbs; which are not only a disgrace to the surgeon, but inconvenient and disagreeable to the patient through life. Therefore that position and mode of treatment, which will the most effectually counteract such effects, should be adopted: and this in fractures of the lower extremities, we presume is the straight posture, combined with a mode of practice to be hereafter mentioned.

IN every case of fracture, the primary object with the patient is to have a straight limb: and so anxious is he to obtain this, that he will bear much pain without murmur. Happily for him and the surgeon of humanity,

the means by which it is effected, are productive of the least pain.

It may be set down as an axiom, that in order to have a straight limb the patient must be placed in the most natural and easy posture; which most undoubtedly is that one in which his body will rest on most points, and have fewest muscles in action.

WHEN a person rests on his side, as it is not a completely natural position, a number of his muscles are in action. He is obliged to flex his hip and knee joints, in order to form as many points to rest on as possible; and even to call in the assistance of his arms for the same purpose; consequently he soon becomes tired of this posture.

WHEN a person is confined to bed with any sickness, we almost universally find him give the preference to a horizontal posture on his back, unless prevented by the particular seat of the disease. The same observation holds good with respect to fractures. I never saw a patient put on his side with a broken leg, who did not in a few hours turn on his back, in spite of every effort to obey the injunctions of his surgeon; and he not unfrequently gets into that position before the surgeon has bent the limb to his satisfaction; the

consequence of which is that the knee is tilted up, and part of the leg raised off the pillow; which will completely prevent it from being made straight. I have heard a surgeon remark, how valuable an acquisition a machine for the purpose of holding down the knee would be; this idea, absurd as it is, serves to show to what lengths the prejudice of education will carry a man. Admitting that a patient could lie on his side, the grand object for which a surgeon is employed would be defeated; the limb would not, except in an accidental case, or what may be called a *lucky hit*, be made straight. In order to effect this, we must not only have the limb in an easy posture, but that posture must be such a one as will admit of comparing the diseased with the sound limb; and ascertaining whether they are alike in length and other circumstances or not. This is the proper criterion for deciding by, and is the one recommended by all the authors I have consulted on the subject, except Mr. POTT. Why he should omit it can only be accounted for on the circumstance of its being incompatible with his bent position.

THERE are also many surgeons who reduce the fracture and dress it while in a straight position, and flex the limb afterward: this itself is sufficient to derange the parts.

WHEN any irritation is given, which affords an equal and universal stimulus to action, those muscles which are strongest will perform the most: and we frequently find in the bent posture, that the broken ends of the bones are pulled past each other, because the *Gastrocnemii* muscles have no proper antagonists, those seated on the forepart of the leg being only destined to assist in performing the motions of the ankle joint and toes. Should the fracture be so transverse as to prevent the ends of the bones from slipping past each other, it will at any rate form a fulcrum for the action of the muscles seated on the posterior part of the leg, and will produce what is called a *bow shin*. But the straight position affords a complete antagonist to this action. The limb cannot be bent unless the heel forms the fulcrum, which is impossible. Perhaps it may be remarked by the advocates of the bent position, that splints can be applied to the forepart of the leg, which will counteract the action of the muscles behind. And a very poor mode of counteracting their action it is. In order to answer the intention, a splint must not only be large and strong, but tightly bound on; the mischievous effects of which must be obvious. Beside, there is not room for a splint of sufficient length to answer any good purpose; and in cases of compound fracture, we often find extensive wounds on the forepart of the leg, to which a

piece of a board is certainly a rough application. I may add, that I have seen it used without fulfilling the intention : indeed it seemed to increase the effect it was designed to obviate. The most distorted limb I ever saw was one, to the forepart of which a splint had been applied. From the application of splints, the patient is often troubled with large sores upon the ancles, which are generally longer getting well than the broken bone : this can easily be accounted for, when we recollect how slow the parts about joints commonly are in going through any healing process : both from their nature, and the degree of motion almost always performed by them.

THESE observations will receive additional support from the events of cases ; in which, by comparative trial, the patients had an opportunity of deciding with respect to ease of posture. A man had his leg broken, and it was laid in the bent position. Shortly after it got well he broke the other : it was laid in the straight position. In point of ease, he gave greatly the preference to the latter. A boy had his thigh broken, and laid in the bent position : he complained often and much of uneasiness. His thigh got well ; and in the course of two weeks after he broke it again in the same place, and it was put in the same position ; but he would not remain in it. After

repeated fruitless attempts, his surgeon was obliged at last to gratify him in the straight posture. By reasoning we can never ascertain the feelings of patients; we must conclude that the position which they prefer is the easiest, and consequently the best.

THERE is one species of fracture, I mean that in which a broken fibula is accompanied with a luxation of the ankle joint, in which the bent position is the best, and for the very same reason that in others the straight one is preferable. The fibula being broken, the support to the outside of the foot is destroyed; and it would be drawn outward by the action of the peronæi muscles, but the side position forms an antagonist and prevents it.

IN consequence of the many objections, to which the bent position with the patient placed on his side was liable, a machine has been invented, by which, at the same time that the patient rested on his back, the limb might be kept in the flexed posture. This is called a "FRACTURE BOX," and from it surgeons have promised themselves every advantage that could be obtained from a relaxed state of the muscles. But still it is objectionable. While the limb is kept in a bent posture of any sort, we are deprived of the

opportunity of comparing it with the corresponding sound one ; and if the declarations of patients merit any attention, it, instead of deserving the preference, is not equal to the straight posture in point of ease. A man was admitted into the PENNSYLVANIA HOSPITAL with a compound fracture of one leg, and a large wound accompanied with an injury of the bone in the other. Both limbs were laid in the straight position, and the patient felt easy : however his surgeon, thinking he could mend the matter, had recourse to the fracture box ; the patient immediately began to complain, and it was laid aside ; when he again felt easy. Another patient in the HOSPITAL had a compound fracture of the leg ; it was at first laid in the usual bent posture, and afterwards in the fracture box : he felt more uneasy in the new than the old posture ; got out of temper with his box, and broke it. This case would seem to prove that it is even the worst position of the three.

It has been urged as an objection to the straight position, that the patient is apt to have a stiff knee-joint. This stiffness of the joint occurs in consequence of a long continued inactive state of the muscles, and will take place in any and every position : and a straight stiff knee is less inconvenient than a crooked one.

FRACTURES of the patella may be either transverse or longitudinal; the former, however, are much the most frequent; which affords an additional proof of the agency of muscles in producing fractures. There are two modes of union in transverse fractures of the patella; very different in nature; depending on the particular situation of the parts. Thus, when the broken pieces of bone are put into complete apposition, union will take place in the same manner as in other fractures: but if the pieces of bone are permitted to remain any considerable distance apart, instead of the common bond of union, a kind of ligament is formed which becomes the connecting medium. This is much the most frequent mode of union, because the action of the extensor muscles of the leg renders it almost impossible to keep the fractured pieces in contact. The power of the patella to produce new bone, appears to be inconsiderable; for when any quantity of new substance is necessary, the bony process is not completed. However, that it does possess this power in some degree is certain; for in longitudinal fractures, where its situation in the pulley of the os femoris, and the action of the extensor muscles must keep the parts in contact, union takes place in the common mode. After fractures of the patella, patients are often troubled with stiffness of the knee joint. This seldom, if

ever, arises from any other cause than the injury done to the joint by inflammation, accompanied with a long inactive state of the muscles. Hence profuse blood-letting, and the antiphlogistic treatment in its full extent, should be practised; together with frequent but gentle flexion and extension of the limb. The straight posture alone is admissible in fractures of the patella.

THE reduction of fractures is, in general, attended with little trouble: simple extension and counter extension being all that, in a majority of cases, are requisite.

UNLESS the laceration be great, or the muscular system in such a state as to be easily thrown into convulsive action, the resistance given is seldom so powerful as to baffle the judicious efforts of two or three persons. But some cases do occur, in which the muscular action is so great, and in others the fracture so complicated, as for instance, when the broken end of a bone is protruded some distance through the integuments, that a very considerable degree of force, perhaps more than ought ever to be used, is resisted. It has been no uncommon thing, both in luxations and fractures, for us to see and hear of six, eight, or even as many men as can stand

round the patient, exerting their utmost force to extend his limb; and not unfrequently without success. If we take a view of the different authors on the subject, we will find that the surgeons of all ages, have put their invention to the rack, to frame machines capable of exerting the greatest possible force; which has sometimes even been so great as to tear the muscles to pieces; while the unhappy sufferer must calmly submit to a fate sanctioned by custom.

THE action of muscles forms the great obstacle to the reduction of fractures; and if it can be prevented or suspended, little difficulty will be experienced.*

THE simple extension of a muscle possessing the power of action, will stimulate it to exert its greatest force, so that it becomes a complete antagonist to the extending power, and must of course counteract its effects. In addition to all this, we frequently have convulsive action to contend with, which is perhaps the most violent that muscles are capable of performing.

* These ideas upon muscular action are of extensive application in the theory and cure of diseases. Muscular action has, by my ingenious preceptor, Dr. PHYSICK, been assigned as the cause why some cases of fistula in ano will not get well without an operation; and why division of the sphincter ani muscle should be conducive to the cure.

HAPPILY for the victim to misfortune, we have a remedy at hand capable of removing all these impediments. Bleeding *ad deliquium animi* produces a suspension of action, and the muscular system, undergoes as complete a state of relaxation as can take place during life. By the assistance of this practice, I believe almost every fracture and luxation may be replaced: it is preferable to all the boasted improvements and inventions of modern surgery; for the extending force of two or three persons is all that will ever be necessary. In recent cases, bleeding just to the fainting point will often be successful; but in those of considerable standing, it would be a good general rule not to attempt the reduction until a complete state of fainting is produced: because the parts have become accommodated by length of time to their new situation, the muscles with reluctance admit a change; and by commencing the extension too soon, the patient is roused, and the very intention of bleeding counteracted.

THIS practice is the most eligible for another reason. In a state of fainting the operations of the mind are suspended, and sensation being one of them cannot exist; therefore the patient feels no pain from the extension or replacement of the limb.

FAINTING is produced with ease and readiness in proportion to the size and velocity of the stream of blood. Should the veins be small or bleed slowly, it may be necessary to open an artery. The radial artery at the wrist, being superficially covered, near a bone, easily secured by compression, and of sufficient size, is perhaps equal to any other. It may be added, that I have repeatedly seen it opened with a lancet, and stopped by a compress and bandage with as much ease as is experienced in the common operation of bleeding in a vein.

IN surgical authors we find cases recorded, in which the broken bones were protruded so far through the integuments, as to render amputation of them necessary, in order to effect a reduction. Bleeding ad deliquium will, I believe, always prevent the necessity of this often cruel practice.

IT has been urged as an objection to bleeding ad deliquium animi, that there is a danger of the patients never recovering from it. If this was not mere hypothesis, if it had one single fact in support of it, it would be sufficient to deter us from ever adopting the practice. The effects produced by a state of fainting and the action of death are very different. In the former, action is suspended, and a great degree of relaxa-

tion takes place, while life exists uninjured. In the latter, where death is natural, visible action ceases much more gradually, so great a degree of relaxation does not take place, and after the actions of the heart and respiration have ceased, the muscles go on to contract for many days. In some cases action and life are destroyed together, as it were in a moment; and the system is incapable of performing the action of death; the muscles remain forever relaxed, neither does the blood coagulate. This is the case in deaths from electricity, blows on the stomach, and passions; also in animals killed in the chase.*

* *A sense of gratitude and justice to a man whom I venerate, not only as a preceptor but a friend, prompts me to make a few observations upon the origin of the practice of bleeding ad deliquium animi, in the reduction of fractures and luxations. From the notes of a surgeon in this city, it appears, that Dr. MONRO recommended the practice in his lectures; this must have been a transient idea with the DOCTOR, one which he never put into practice; neither is there any instance on record in which it was ever practised: and the latest writers on surgery do not so much as hint at it. A gentleman lately from EDINBURGH objected to the practice, because it was not used in the ROYAL INFIRMARY. And a few years ago, a case of luxated os humeri occurred in the PHILADELPHIA DISPENSARY, which baffled all the exertions of the surgeons to reduce. Although the gentleman whose notes we hinted at above was present, yet the idea was never suggested: whence we conclude that it might have remained for ages buried in oblivion, had not Dr. PHYSICK come forward at a happy moment, and discovered its efficacy to the world. Undoubtedly he is as much entitled to the credit of author of this practice, as Dr. HARVEY is to the discovery of the circulation.*

I BELIEVE the splints in common use are not only very useless things, but often injurious; in order to fulfil their intention they must be bound on with a degree of tightness which seldom fails to augment the irritation and inflammation. In the common mode of applying splints, the limb, in a lateral direction, would be made completely straight, but which, in perhaps a majority of cases, is, and ought to be, considered crooked. Every deviation from the original shape of a limb is a distortion. Men in general have a greater or less degree of what are called *bandy-legs*; and when such limb, by a particular mode of treatment, is made to deviate from its former shape, or from that of the sound limb, which would be the case if completely straight, it most undoubtedly deserves the appellation of *crooked*.

THE most successful and easy mode of treating a broken leg, is to place a board on the bed or mattraß, put a pillow on the board, and lay the limb in a horizontal position on the pillow; the sides of which must be pressed up against the leg; then let two thin pieces of board or shingles, as long as the limb, be placed one on each side of the pillow, and secured by tapes passed under it, and tied moderately tight. Any disagreeable effects from pressure are prevented by the interposition of the pillow: the limb may be com-

pletely reduced to its former shape ; for the purpose of ascertaining which, it should be compared with the corresponding sound limb ; and retained by stuffing in a little tow, or a few rags at the necessary points. For a fractured thigh, the board, pillow, and side pieces should be of sufficient length to extend from the top of the thigh, below the foot. The lower end of the board should be elevated so as to raise the heel higher than the hip : it will contribute considerably to the ease of the patient, and somewhat to the straightness of the limb. It may be here observed, that persons sometimes get both legs broken, and we have no sound limb for a criterion : this is a very uncommon accident, and when it does occur, we must reduce the limbs as near the natural state as possible, and compare them together, so that they shall at least be alike. I may just remark, that in such cases the bent posture is wholly inadmissible. This is all that will in general be necessary in simple fractures, with respect to local treatment : but inflammation and its consequences are to be particularly guarded against ; for which purpose blood-letting should be practised as often and as copiously as the symptoms and pulse indicate.

WELL knowing the timidity of practitioners with respect to the free use of the lancet, the ma-

ny doubts and falsehoods that are raised in opposition to it; and in order that the mouths of prejudice and superstition may be stopped; I shall make a few observations upon the propriety of the practice in fractures; shewing how clearly it is indicated, and also adduce a few, out of many cases, as examples of its success.*

IN every case of injury, whether great or small, the primary and grand object should be to guard against inflammation: either to prevent it altogether, or lessen and remove it when produced. We have the united testimony of surgical authors in favour of the most profuse blood-letting in wounds of vital parts, such as the lungs, bowels, &c. But when a person is so unfortunate as to receive an injury in any of the extremities, parts not so vital, and parts, the existence of which is not even necessary to the continuance of life, and consequently with the diseases of which the constitutional sympathy is not so great; we find that instead of the lancet, bark and wine are prescribed, as if these parts were not subject to the same laws with the system at

* It is my design in a few of the following pages, to give a compendious view of the indications for the lancet in fractures; it may therefore be considered as a defence of the practice. I shall however notice it in other parts, when treating of the symptoms relating to it.

large, both in health and disease; differing only in point of utility in the former, and violence of symptoms in the latter. It would seem as if surgeons thought diseases of these parts unworthy of proper and serious attention; because they do not generally and instantly prove fatal. But this is no reason why the cure should be protracted by improper treatment, or life endangered in a single instance by neglect.

A SYMPTOM which not unfrequently occurs in fractures, and sometimes becomes very troublesome, is convulsive action of the muscles connected with the injured limb. It is sometimes caused by the irritation given upon any motion of a bone obliquely fractured; at others, by the violence done to the parts at the time the injury was received. In such cases any immediate attempts to replace the parts, and retain them by force, will generally be worse than useless; as they will increase the violence of the symptoms. Of this sort a remarkable instance occurred a few months ago. A man who had been accustomed to drink ardent spirits freely, and whose system was in an irritable state, fell down on the floor, and received a very oblique fracture of the bones of his right leg. During the first attempt to replace the parts, severe spasms came on, and continued to occur for four or five days, at every

successive attempt to perform a reduction; so that the limb was generally found more distorted after it was tied up than before. During this time the lancet was used very freely. However it was at length determined to postpone any attempt to reduce the fracture, and endeavour to remove the disposition to spasm. This was effected by repeated bleedings and cathartics, with a vegetable diet. From the time the accident happened until the ninth day, the patient lost one hundred and twenty-five ounces of blood; which conquered the disposition to spasms: as they did not return when an attempt was made to reduce the parts; which was effected with ease. The limb remained in place and got well without further trouble. In this case, the attempts to effect a reduction evidently did harm. The mode of practice scarcely requires a comment. The disease was convulsive action of the muscles, connected with the injured limb; and bleeding acted as a sovereign remedy.

THE next symptom to be noticed is inflammation. This will generally be in proportion to the extent and nature of the injury, combined with the irritability of the system. It is true that a certain degree of inflammatory action is necessary to produce union of the fractured bones; but the danger is, not that there be too little in-

flammation, but least too much take place : and our object should be to guard against it as much as possible. Here I might state many cases in which copious blood-letting had been performed ; but a particular detail of them, like multiplied experiments to prove the same point, would only serve to swell the dissertation : it is sufficient to remark that the practice was uniformly successful.

MORTIFICATION may arise from two causes. The violence offered at the reception of an injury may be so great, as instantly to destroy the life of the part ; and a slough must be the consequence. Mortification from this cause cannot be prevented, and our object should be to guard against inflammation in the adjoining parts. This may be done by bleeding, cathartics, low diet and some easy application to the parts ; perhaps poultices of bread and milk are equal to any other. But by far the most frequent source of mortification in fractures, is a destruction of the balance between the power and action ; the former being wasted by an excess of the latter. In such cases it is clear, that the only certain mode to prevent this alarming termination, is by reducing the action, and keeping it on a level with the power.* A free use of the lancet would at

* *Vide HUNTER on the blood, page 8th of the introduction.*

first sight, appear eminently calculated to fulfil the intention: but the propriety of its use does not rest on theory alone; experience has demonstrated it: and the practitioner who will adopt it in sufficiently extensive degree, need not be afraid of disappointment.

I CANNOT here avoid stating one single case.

A YOUNG man received a gunshot wound in the right leg. At the time the accident happened he was about two feet distant from the muzzle of the gun, which was loaded with shot. The whole load entered in a body into the anterior part of the limb, and passed directly through the tibia, shattering it into numberless small pieces. The fragments of bone taken out during the cure, amounted at least to sixty in number. From the resistance given by the tibia, the grains of shot were diverted from their original course; so that the wound caused by their passage out at the posterior part of the limb, was four times as great as that by which they entered. The hemorrhage was very considerable. The fibula remained sound. The appearance was so unpromising, that a physician, who was called in, determined on amputation. However, upon further advice, it was agreed that an attempt should be made to save the limb. Large poultices of bread and

milk were applied; the bowels were kept open by glauber salts; the patient was bled twice the first day after the accident; thrice the next; and in the course of the first six days lost one hundred and fifty ounces of blood. Several small bleedings were performed afterwards as occasion required. The parts destroyed by the violence of the injury sloughed off. Not a symptom of gangrene supervened to the inflammation which took place. The discharge of pus was so trifling in quantity, and inoffensive in smell, that, after a few days, the dressings were renewed but once in twenty-four hours: and after a confinement of six months he recovered; the limb was saved; and his constitution remained uninjured; having never been threatened with a single symptom of hectic. It may be added, that after this immense loss of blood, and at a time when the patient's strength was most reduced, he got the small pox in the natural way, and had a great number of them. Here again he lost fifty ounces of blood, and was purged freely. Not one symptom of dropsey succeeded all these evacuations. It may be remarked, that neither anasarcaous swellings of the ancles, or any other form of dropsey has ever occurred in one single case of fracture. where I have seen the lancet freely used; although dropical swellings of the feet and ancles are very frequent, in cases where bleeding is either not at all, or but sparingly practised.

THE discharge of pus will generally be in ratio with the degree of action in the vessels, and irritation in the part. In this respect an ulcer is exactly upon a footing with every other secreting surface in the body. If the inflammation set up in consequence of an injury to the soft parts, accompanied with a breach of substance, be great, the quantity of pus secreted will be great also. Hence it is clear that a mode of practice which will moderate inflammation, will also diminish the discharge. The case last stated may be adduced, in support both of the principle and practice.

THE next and last consequence of fractures I shall notice, is the loss of life in a part of the injured bone. It may be observed however that this seldom occurs, except in compound fractures. Whenever any part of a bone loses its life, it becomes unfit to answer the purposes for which it was originally designed; and therefore gives the stimulus of an extraneous body; and actions for the purpose of removing it are set up. It is a principle too clearly demonstrated to require further investigation, that the same vessels cannot perform two different actions at once. It is also true, that when violent action is going on in one set of vessels in a part, the action of other vessels in the same part will generally be very much di-

minished. Of this we have a satisfactory example in the process of exfoliation. When inflammation is great, the quantity of bone destroyed will not only be greater, but exfoliation much more tedious. Bones are endowed with less powers of action and resistance in disease, than many other parts of the body: hence we find their life easier destroyed, their progress in separating the dead from the living parts slower, and their action of restoration more tedious. Here again the principle of keeping action on a level with the power is applicable: indeed it is more necessary; the parts being endowed with less capacity for resistance.

WHEN the reduction of a fracture has been omitted for some time, and considerable swelling and tension taken place, we are advised to defer every attempt to replace the parts, and direct all our efforts to check the inflammation. Perhaps in some cases this may be necessary; but it is certainly a very desirable object to have the bone put in place as soon as possible: and with the assistance of bleeding *ad deliquium animi*, I believe it may almost always be effected with ease.

IN consequence of an irritable disposition in the parts, they sometimes run into such a degree

of convulsive action, that the limb cannot be kept straight in any posture. In such cases bleeding is peculiarly necessary and useful.

THERE is sometimes a strong disposition in the injured parts to take on the gangrenous state, even when the system does not sympathize much with the local injury. Exposure to cold appears particularly to induce this state. Under such circumstances large doses of Musk and Volatile Alkali have been serviceable. But we much more frequently find the gangrenous stage the effect of, and accompanied with excessive action. When this is the case, blood-letting and other evacuants should be used. It is always easier and better to prevent gangrene than to stop it after its commencement; for which purpose early and copious bleeding should be practised. If this be neglected, it not unfrequently runs on and changes a simple into a compound fracture, by producing sloughs from the injured part. This, although bad enough, is perhaps the least alarming of its terminations. As a topical application, when such is necessary, perhaps large poultices of bread and milk are equal to any other.

FRACTURES are often accompanied with wounds and bruises of the scalp, and concussions of the brain. Under these circumstances, copi-

ous blood-letting is doubly requisite, and peculiarly serviceable. We frequently find in such injuries of the head, that the pulse is depressed; this is one of the loudest calls disease can give for lancet.

I HAVE seen a case of compound fracture of the leg, accompanied with a wound in the forehead. Shortly after the accident, vomiting, headache, and other symptoms of concussion took place, with a depressed pulse. The physicians, thinking the pulse indicated a great degree of direct debility, ordered spiced wine, ether and laudanum. These, as might have been expected, augmented all the symptoms, until, fortunately for the patient, a profuse hemorrhage from the wound in his leg came on, and relieved him completely.

I HAVE lately witnessed a case of fractured and depressed cranium, with blood extravasated under the dura mater to such a degree, that it protruded through the openings made by the trephine. The patient, a boy of twelve years old, was bled sixteen times and purged freely; part of the dura mater sloughed off, granulations rose up under it, and he recovered.

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THERE are some unfortunate cases in which the broken ends of the bone do not unite by the first intention. The inflammation subsides, and the integuments resume their former appearance, but the bones remain separate. I have seen a case of this sort, which, in the first stage, had a strong disposition to gangrene. Perhaps they are always the consequence of some disease in the part, which destroys the first bond of union. In such cases authors advise an incision to be made down to the bone, and the ends of it sawed off; this last part of the practice can never be necessary, and the first but seldom. A mode of practice which has been successful, and at least merits a trial, is to make the patient exercise his limb so as to produce inflammation; this causes an extravasation of coagulating lymph, and the parts are united by a kind of granulation.* Should this be unsuccessful, all that can ever be necessary, is to reduce it to the state of a compound fracture, by a simple incision; for there are few if any instances, in which union does not take place in compound fractures. If any part of the bone be dead, it will exfoliate, and should be removed when loose. If this be neglected, a bony case will be formed round it; the consequence of which will be a tedious and disagreeable sore.

* *Vide HUNTER on the Blood, page 475.*

I have heard of a case in which sawing off the ends of the broken bone was unsuccessful. It can easily be conceived, that parts, capable of producing a small quantity of bone, should, notwithstanding, be incapable of forming as much as would be necessary after such an operation.

EVERY fracture communicating with an external wound may be termed compound. They are much more complicated and dangerous than simple fractures; and therefore require the most serious attention.

THE danger attending a compound fracture, depends on the laceration and extent of wound in some measure; but more especially upon the stimulus given by exposure, which seldom fails to excite a considerable degree of inflammation. We do not find that greater violence of symptoms accompanying extensive wounds which ought to take place, if much depended on the degree of laceration: and if the edges or sides of the wound can be brought to unite by the first intention, it is at once reduced to the state of a simple fracture; and heals without further trouble.

MUCH has been said by surgeons about the mischievous effects of air, when admitted into wounds and cavities. The idea at first sight ap-

pears plausible, but is certainly not sufficient to account for all the consequences resulting from exposure of internal parts. If air be admitted into a cavity, and it be rendered perfect again, no inflammation takes place.* In cases of emphysema, although the whole cellular membrane be filled with air, inflammation is not produced. Air is admitted every minute through the mouth into the bronchial vessels, without causing the smallest degree of inflammation; but if an opening be made through any part of the chest into the lungs, the whole surface of these vessels will inflame, if permitted for any length of time to remain exposed. We must therefore refer the inflammation produced in such cases to some other cause. The stimulus given by, and actions set up in consequence of a state of imperfection or exposure, have, by the late ingenious MR. HUNTER, been considered as the causes producing such effects. In proportion to the ease with which any exposed part is made whole, the inflammation will be small in degree, and vice versa. In cases of wounds into cavities, the inflammation set up is generally incapable of producing restoration; hence it does harm. This is the reason why we are so often obliged to have recourse to amputation, in wounds where the cavities of joints are exposed.

* *THIS fact has been ascertained by repeated experiments.*

It would certainly be a good practice to reduce compound fractures to the simple state. This, although not always practicable, may often be effected by approximating the edges of the wound, and retaining them by strips of sticking plaster, and a bandage, until union has taken place. A man, by trade a carpenter, fell from the top of a three story building into the cellar, and received a compound fracture of his right thigh. The wound was situated on the external part of the thigh, and of sufficient size to permit the fractured end of the bone to protrude through the integuments. The limb was laid in the straight posture; the lips of the wound were drawn together and retained by strips of sticking plaster; a bandage was applied: the patient was repeatedly and freely bled, union by the first intention took place, and an unpromising compound fracture was reduced to the simple state; and got well without further trouble. In order as much as possible to insure success to the practice, the limb should be kept perfectly quiet, and the inflammation prevented, by bleeding and other evacuations, from passing the adhesive, and running on to the suppurative stage. When the reduction of a compound fracture to the simple state is altogether impracticable, or any attempts for that purpose have failed; the next object should be to prevent vio-

lent inflammation, and its consequences, mortification, large suppuration, &c. For this purpose the evacuating plan, bleeding particularly, should be early practised. By it, inflammation is moderated, gangrene is prevented, the discharge of pus is rendered small; and limbs may, and have been saved by this mode of treatment, which certainly would have been lost under any other. Blood-letting, by promoting absorption, expedites the exfoliation of dead bone.

It was an ancient opinion, and is still the opinion of many, that the solids enter into the composition of pus: that in order to the healing of any sore, it must discharge a determinate quantity of pus: and that pus corrodes or destroys the living solids. SIR JOHN PRINGLE has made a number of experiments with pieces of dead animal matter and pus, and finding that the dead flesh was dissolved, directly concluded that pus was capable of corroding and dissolving the living solids. But *living* and *dead* animal matter can never stand upon the same footing*. While physicians were advancing such opinions, it would seem they had forgotten that a sore continues to secrete pus during the whole of its

* *Vide HUNTER on the blood, page 415, &c. chapter 5th, on pus.*

cure; and that such sore ought never to get well while covered with a fluid capable of continually corroding and destroying its surface. Besides, we often find large quantities of pus in the thorax without the smallest breach of substance: and the whole penis would not afford matter enough to form one fourth part of the pus usually discharged in a gonorrhœa.

EVERY fluid seems to be in harmony with the surface which secretes it. The idea may be extended further. The fluid of one secreting surface generally harmonizes with other secreting surfaces. The urine passes harmlessly thro' the ureters, bladder and urethra; these however may with strict propriety be considered as the excretory ducts of the kidneys. The tears injure not the tender tunica adnata, but if permitted to flow over the cheek will excoriate it prodigiously. If urine is permitted to flow into the cavity of the abdomen, or into the cells of the cellular membrane, it will cause terrible inflammation.

THE practice founded on the idea that pus is capable of corroding the living solids, is to make counter openings when the sore has not a discharge from a depending situation. I have seen a surgeon make an incision through the

whole mass of the gastrocnemii muscles, and introduce a seton to form a depending drain from an abscess on the shin, in a case of compound fracture. The opening healed up in a few days, not having in any degree fulfilled the intention; and the fore got well without it. This was adding irritation upon the back of irritation, which should always be avoided*. The same idea has given rise to the practice of washing and wiping sores; which, as it is irritating tender parts, must always be improper; except where caustic is to be applied for the purpose of destroying a luxuriant or unhealthy part.

I HAVE already extended this dissertation beyond the limits at first prescribed to it; and will now conclude with a few observations upon the mode of union between the broken ends of bones.

THE mode of union in fractures depends on the nature of the injury received. Thus in simple fractures, and compound ones rendered simple, the extravasated blood forms the connecting medium. But in compound fractures, as this first bond of union is lost, granulations arise

* It is not meant to insinuate that counter openings are never useful, but certainly they can only be proper when the pus acts as an extraneous body.

and fulfil the intention. This process however is much the most tedious. The coagulating lymph appears to be the part of the blood capable of taking on the solid form; the serum is absorbed; vessels shoot through the coagulum, and it becomes an organised part; gradually taking on the solidity of muscle, cartilage, and finally bone. All this is the effect of actions which appear to be regulated by the nature of the parts, and a law of necessity. In some cases of simple fracture this first mode of union is lost, and the parts form granulations without suppuration; and are united by these. In consequence of the exposure of internal parts (which is the case in compound fractures) suppuration generally takes place, and granulations shoot up. These are formed from the blood by a particular action of vessels, and constitute the last mode of union. In such cases union by the first intention cannot take place; the blood is discharged by the wound, and the parts being subjected to the stimulus of exposure, inflammation and suppuration take place, and granulations arise; which appear to be formed of coagulating lymph: vessels shoot thro' these, and the new formed parts gradually take on the solidity of bone.

THESE different modes of producing restoration must be considered as healthy processes;

for the effects of disease are injury and destruction. Hence the best mode of promoting union in fractures is to prevent disease, or remove it when produced. I will close the dissertation by again recommending the free use of the LANCET.

